

*PARASPADELLA ANOPS*, NEW SPECIES, FROM  
SAGITTARIUS CAVE GRAND BAHAMA ISLAND,  
THE SECOND TROGLOBITIC CHAETOGNATH

Thomas E. Bowman and Robert Bieri

*Abstract.*—*Paraspadella anops* is described from a single specimen collected in Sagittarius Cave, Grand Bahama Island. It lacks eyes and body pigmentation, and is the first fully troglobitic chaetognath discovered. In morphological details it closely resembles *P. schizoptera* (Conant), but is much slenderer than the latter. The separation of *Paraspadella* Salvini-Plawen, with two pairs of lateral fins, and *Gephyrospadella* Salvini-Plawen, with one pair, is rejected, since in the former the two pairs of fins are continuous in young specimens and only separated at sexual maturity by lateral growth of the vaginas. *Gephyrospadella* is reduced to a synonym of *Paraspadella*.

Until the discovery of the species described herein, the only chaetognath reported to be troglobitic was *Spadella ledoyeri* Casanova, 1986, from a marine cave about 15 km east of Marseille, France. In contrast to *Paraspadella anops*, however, *S. ledoyeri* has well developed eyes having “grand développement de la tache pigmentaire,” which Casanova considered an adaptation to the reduction or absence of light in the interior of the cave. Casanova said nothing about the presence or absence of body pigment in *S. ledoyeri*.

*Spadella equidentata* Casanova, 1987, from 452 m in the Gulf of Cadiz, south of Portugal, was described as having not a trace of eyes, even after staining with methylene blue. However, Casanova (1987) remarked that the absence of eyes required confirmation.

The new species described herein is the first truly troglobitic chaetognath that lacks both eyes and body pigment.

Spadellidae Tokioka, 1965

*Paraspadella* Salvini-Plawen, 1986

*Type species.*—*Spadella schizoptera* Conant, 1895a (original designation).

*Paraspadella anops*, new species

Figs. 1–3

*Material.*—Bahamas, Grand Bahama Island, Sweeting's Cay, Sagittarius Cave (26°37'N, 77°53'W), leg. Dennis Williams and Jill Yager, 17 Dec 1987, holotype, USNM 120108.

*Etymology.*—From the Greek “an-” (without) + “ops” (eye), alluding to the absence of eyes.

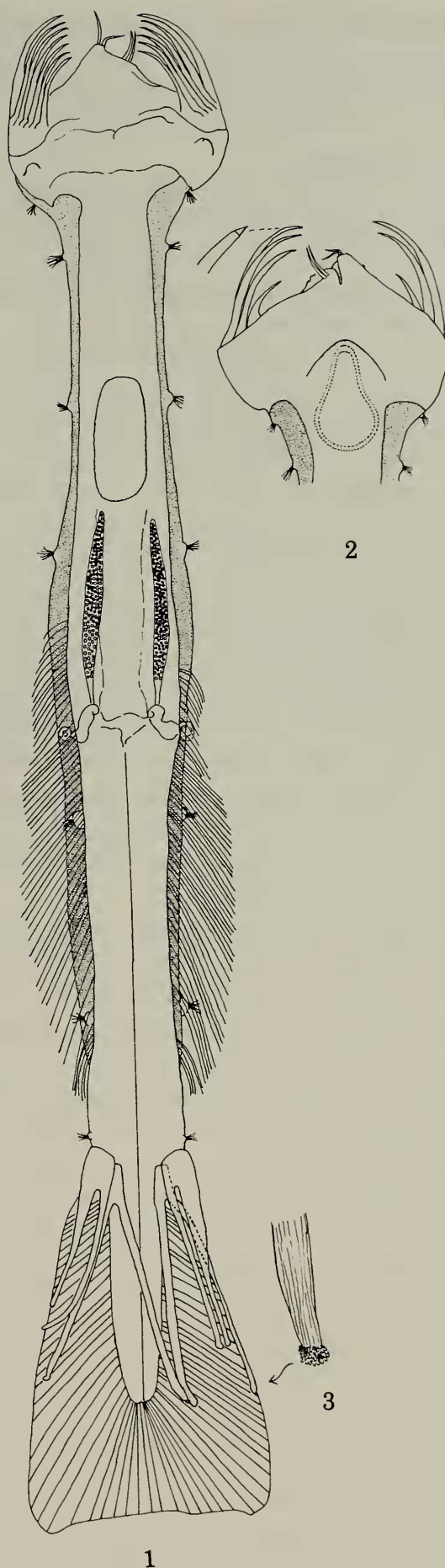
*Description.*—Total length, excluding tail fin, 3.55 mm. Length of tail 1.75 mm = 49.3% of total length. Eyes and body pigment totally lacking. Head about 1.4× as wide as long, about twice as wide as trunk and 2.7× as wide as tail. Grasping spines 10 on each side, each with tip set off by suture. Anterior teeth two on each side, elongate. Posterior teeth lacking. Corona ciliata pyriform, length about 1.6× greatest width, which is near posterior end. Collar-ette extending from posterior end of head to anterior insertion of tail fin. Lateral margins of collar-ette of trunk with four pairs of sensory tufts, of tail with three pairs. Anterior intestinal diverticula not evident in the undissected specimen. One pair of lateral fins, completely rayed, extending from

distance equal to body width anterior to beginning of tail to short distance anterior to attachment of adhesive organs; fin width increasing posteriorly to maximum slightly posterior to fin midlength, thereafter decreasing. Tail fin beginning just posterior to insertion of adhesive organs; lateral margins nearly straight; posterior margin, which appears somewhat frayed, slightly concave.

Adhesive organs inserted on ventral surface of tail, each with four slender fingers. Outer two and inner two fingers each with common base. Outer two fingers subequal, about half length of tail fin; inner two fingers with inner member slightly longer, about two-thirds length of tail fin, reaching posterior margin of tail. Fingers longitudinally striated; tips of most fingers eroded, but one relatively undamaged tip covered with small papillae (Fig. 3).

Ventral ganglion oval, occupying middle one-fifth trunk. Ovaries immature, extending slightly anterior to 4th pair of sensory tufts. Transverse musculature appears to extend from posterior end of head to posterior margin of ventral ganglion.

*Comparisons.*—Of the known species of *Paraspadella*, *P. schizoptera* (Conant, 1895) most closely resembles *P. anops*. The two species agree in the numbers of grasping spines and anterior teeth; both have pyriform coronae ciliatae, and the number, form, and arrangement of the fingers of the adhesive organs are identical. However, *P. schizoptera* has well developed eyes and is heavily pigmented compared with most other chaetognaths (Feigenbaum 1976). It is also a stockier species than the very slender *P. anops*, whose length (excluding the tail fin) is about  $9.5 \times$  its greatest trunk width. The length : width ratio of *P. schizoptera* in published illustrations is as follows: 6.5



Figs. 1–3. *Paraspadella anops*: 1, Habitus, ventral (not all 10 pairs of grasping spines shown; many fin rays omitted); 2, Head, dorsal; 3, Tip of finger of adhesive organ.



(Conant 1895a, fig. 6, 3.5 mm specimen), 7.8 (Owre 1963, fig. 1a, 1.7 mm specimen), 7.9 (Owre 1972, pl. 2, fig. 1, 3.8 mm specimen), 5.3 (Feigenbaum 1976, fig. 2f, 1.4 mm specimen).

Because of these differences, it is our subjective opinion that *P. anops* merits recognition as specifically distinct from *P. schizoptera*, but the latter is clearly the ancestor of our new species.

*The genera of Spadellidae.*—Prior to Salvini-Plawen's two new genera, the family Spadellidae Tokioka, contained only the genus *Spadella*, although three species-groups corresponding to the three genera recognized by Salvini-Plawen had been proposed. Salvini-Plawen (1986) assigned the 13 then known species of *Spadella* to 3 genera: *Spadella* Langerhans, 1880 (type species *Sagitta cephaloptera* Busch, 1851), one pair of lateral fins, no adhesive organs; *Gephyrospadella*, new genus (type species *Spadella pulchella* Owre, 1963), one pair of lateral fins, adhesive organs present; *Paraspadella*, new genus (type species *Spadella schizoptera* Conant, 1895a), two pairs of lateral fins, adhesive organs present.

We agree that the presence or absence of adhesive organs is significant at the generic level, but we have reservations about the supposed two pairs of lateral fins. Illustrations of *Paraspadella schizoptera* show specimens with two pairs (Conant 1895a, Owre 1972) and one pair (Owre 1963, Feigenbaum 1976) of lateral fins. Where there are two pairs, the gap between them is much smaller than in species of *Sagitta*, in which the anterior and posterior fins are widely separated. In *P. schizoptera* the fins are either continuous or separated only by the width of the female gonopore and vagina. It appears that the lateral fins are single in sexually immature individuals, but with the development of sexual maturity they become separated into anterior and posterior parts by lateral growth of the vagina. This slight separation scarcely warrants the recognition of two pairs of fins.

This observation leads us to combine Salvini-Plawen's proposed new genera, *Gephyrospadella* and *Paraspadella*, since they differ only in the supposed number of paired lateral fins. Acting as first revisors (ICZN Article 24), we may select one of the names. Salvini-Plawen did not give the derivation of his new generic names, but it is obvious the "Gephyro" means "bridge" and "Para" means "near." Salvini-Plawen's fig. 3 shows *Geophyrospadella* bridging the evolutionary pathway between *Spadella* and *Paraspadella*. Combining the new genera eliminates the bridge, hence we select *Paraspadella* rather than *Gephyrospadella*. This act reduces the number of genera of Spadellidae to two: *Spadella*, without adhesive organs, and *Paraspadella*, with adhesive organs.

*Habitat.*—A detailed description of Saggiattarius Cave is given by Cunliffe (1985). It is an anchialine cave beneath the small island of Sweeting's Cay at the east end of Grand Bahama Island. The single specimen of *P. anops* was found swimming in the water column in an area completely devoid of light, more than 100 m inward from the surface entrance to the cave. The salinity was 35‰. Associated fauna include remipedians, ostracodes, amphipods, isopods, mysidaceans, thermosbaenaceans, and cave fishes.

### Acknowledgments

Our sincere thanks go to the collector, Jill Yager, who sent us the specimen, together with collection data.

### Literature Cited

- Busch, W. 1851. Beobachtungen über Anatomie und Entwicklung einiger wirbellosen Seethiere. Berlin, viii + 143 pp., 17 plates [Chaetognatha, pp. 93–100].
- Casanova, Jean-Paul. 1986a. *Spadella ledoyeri*, chaetognathe nouveau de la grotte sous-marine obscure des Trémies (calanques de Cassis).—Rapports et Procès Verbaux des Réunions Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée 30(2):196.

- . 1986b. Découverte en Méditerranée d'un chaetognathe nouveau du genre archaïque profond *Archeterokrohnia*: Description et signification biogéographique.—Rapports et Procès Verbaux des Réunions Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée 30(2):196.
- . 1987. Deux chaetognathes benthiques nouveaux du genre *Spadella* des parages de Gibraltar: Remarques phylogénétiques.—Bulletin du Muséum National d'Histoire Naturelle, Paris, series 4, 9 (section A, no. 2):375–390.
- Conant, F. S. 1895a. Description of two new chaetognaths: *Spadella schizoptera* and *Sagitta hispida*.—The Johns Hopkins University Circulars 14(119):77–78.
- . 1895b. Description of two new chaetognaths (*Spadella schizoptera* and *Sagitta hispida*).—Annals and Magazine of Natural History, series 6, 16:288–292. (Verbatim reprint of Conant 1895a).
- Cunliffe, Sarah. 1985. The flora and fauna of Sagittarius, an anchialine cave and lake in Grand Bahama.—Cave Science 12(3):103–109.
- Feigenbaum, David L. 1976. Development of the adhesive organ in *Spadella schizoptera* (Chaetognatha) with comments on growth and pigmentation.—Bulletin of Marine Science 26(4): 600–603.
- Langerhans, P. 1880. Die Wurmfauna von Madeira III.—Zeitschrift für Wissenschaftliche Zoologie 34:132–136.
- Owre, Harding B. 1963. The genus *Spadella* (Chaetognatha) in the western North Atlantic Ocean, with descriptions of two new species.—Bulletin of Marine Science of the Gulf and Caribbean 13(3):378–390.
- . 1972. Marine biological investigations in the Bahamas 18. The genus *Spadella* and other Chaetognatha.—Sarsia 49:49–58.
- Salvini-Plawen, L. v. 1986. Systematic notes on *Spadella* and on the Chaetognatha in general.—Zeitschrift für Zoologische Systematik und Evolutionsforschung 24(2):122–128.
- Tokioka, Takasi. 1965. The taxonomical outline of Chaetognatha.—Publications of the Seto Marine Biological Laboratory 13(3):335–357.
- (TEB) Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560; (RB) 175 Brookside Drive, Yellow Springs, Ohio 45387.